



The Solar System

Section 1 The Solar System

Underlined words and phrases are to be filled in by students on the Note-taking Worksheet.

A. Ideas about the night sky have changed over time.

1. Earth-centered model—early Greeks thought planets, Sun, Moon, and stars rotated around Earth.
2. Sun-centered model—Nicholas Copernicus and Galileo Galilei observed that the Moon revolved around Earth and that Earth and the other planets revolved around the Sun.
3. Modern view—solar system includes Sun, eight planets, many small objects, and a huge volume of space.
 - a. Sun is the center of the solar system
 - b. All other objects in the solar system revolve around the Sun.

B. How the solar system formed

1. A nebula of gas, ice, and dust slowly formed in space
2. A cloud of material in the nebula slowly rotated in space.
3. Shock waves might have caused the cloud to contract, and the matter was squeezed into less space.
4. The cloud became more dense, rotated faster, heated up, and flattened to form a disk
5. As the cloud contracted, it grew warmer, triggering a nuclear fusion reaction that created the Sun.
6. The leftover matter became the planets and asteroids.
 - a. First four inner planets—small and rocky with iron cores
 - b. Last four outer planets—large and lightweight

C. Planet motion

1. Copernicus—planets had circular orbits around the Sun.
2. Johannes Kepler—German mathematician
 - a. Discovered that the planet orbits were elliptical and that the Sun was not directly in the center of the orbits
 - b. Determined that planets do not orbit the Sun at the same speed

DISCUSSION QUESTION:

Why is the Sun at the center of the solar system? *It is by far the densest object in the solar system.*

Content Outline for Teaching (continued)

Section 2 The Inner Planets

- A. Mercury—closest to the Sun, second-smallest planet
1. Weak magnetic field suggests an iron core
 2. Has many craters and high cliffs
 3. No true atmosphere, so surface temperatures range from very hot to very cold
- B. Venus—second from the Sun and similar to Earth in size and mass
1. Extremely dense atmosphere of clouds
 2. Carbon dioxide gas traps solar energy.
 - a. Causes an intense greenhouse effect
 - b. Results in surface temperatures between 450°C and 475°C
- C. Earth—third planet from the Sun
1. Average distance between Earth and the Sun is 150 million km
 2. Water exists on surface as solid, liquid, and gas.
 3. More than 70 percent of surface covered with water
 4. Atmosphere protects surface from most meteors and Sun's radiation
- D. Mars—fourth planet from the Sun
1. Called red planet because iron oxide in rocks makes them reddish-yellow
 2. Polar ice caps made mostly of frozen carbon dioxide and frozen water
 3. Has largest volcano in the solar system
 4. Soil shows no evidence of life.
 5. Has gullies and deposits of soil and rocks, which may indicate the presence of liquid groundwater
 6. Thin atmosphere of mostly carbon dioxide
 7. Strong winds caused by differences in temperature between day and night
 8. Is tilted on its axis, which causes seasons
 9. Two small moons: Phobos and Deimos

DISCUSSION QUESTION:

What does a planet's atmosphere do? *Protect planet surface from meteors, Sun's radiation; moderates temperature*

Section 3 The Outer Planets

- A. **Jupiter**—fifth planet from the Sun, largest planet in the solar system
1. **Atmosphere**— primarily hydrogen and helium
 - a. Below atmosphere, **liquid** hydrogen and helium are suspected.
 - b. Solid rocky **core** may exist below liquid level.
 - c. The **Great Red Spot** is the most spectacular of Jupiter's many constant high-pressure gas storms.
 2. Has at least 61 **moons**—four are relatively large and have atmospheres
 - a. **Io**—is very volcanically active; the closest large moon to Jupiter
 - b. **Europa**—composed mostly of rock; may have an ocean of water under a thick layer of ice
 - c. **Ganymede**—largest moon in solar system, even larger than planet Mercury
 - d. **Callisto**—cratered rock and ice crust may surround a salty ocean and rock core
- B. **Saturn**—sixth planet from the Sun, second largest in the solar system, lowest density
1. Thick outer **atmosphere** of hydrogen, helium, ammonia, methane, and water vapor
 2. Might have a small, rocky **core**
 3. Each large **ring** composed of thousands of ringlets of ice and rock particles
 4. Has at least 31 **moons**
 - a. Largest moon, **Titan**, is larger than the planet Mercury.
 - b. Thick **clouds** on Titan prevent scientists from seeing surface.
- C. **Uranus**—seventh planet from the Sun, large and gaseous
1. Has thin, dark **rings**
 2. **Atmosphere** of hydrogen, helium, and methane
 3. Methane makes the planet **bluish-green** in color.
 4. Axis of rotation nearly **parallel** to plane of orbit
- D. **Neptune**—usually the eighth planet from the Sun, large and gaseous
1. Bluish-green-colored **atmosphere** similar to that of Uranus
 2. Storms on Neptune reveal an **active** and rapidly changing atmosphere
 3. Has at least 11 **moons**, of which pinkish Triton is largest
- E. **Pluto**—dwarf planet, occasionally closer to the Sun than Neptune, one of the three dwarf planets
1. Has a thin **atmosphere** and a solid, rocky surface

Content Outline for Teaching (continued)

2. Has three moons.
3. The IAU defined the terms planet and dwarf planet in 2006.

DISCUSSION QUESTION:

What characteristics of Pluto make it different from the other outer planets? *Small size, thin atmosphere, single moon, solid surface*

Section 4 Other Objects in the Solar System

A. **Comet**—dust and rock particles combined with frozen water, methane, and ammonia

1. Halley's comet orbits the Sun every 76 years.
2. Oort Cloud—large group of comets surrounding solar system beyond Pluto
3. Amateur astronomers discovered Comet Hale-Bopp in 1995
4. Comet structure—large dirty snowball of frozen rock and ice
 - a. Ice and dust vaporize as comet nears Sun.
 - b. Vaporized material forms bright cloud called coma around comet nucleus.
 - c. Solar wind pushes on gas and dust in the coma, causing the particles to form a tail that always points away from the Sun.
 - d. Eventually, most of the ice in the comet's nucleus vaporizes, leaving only small particles.

B. Small pieces of the old comet's nucleus

1. Meteoroid—name given to small pieces of comet when they move through space
2. **Meteor**—small meteoroid that burns up in Earth's atmosphere
3. Meteor showers—occur when Earth's orbit passes through a group of meteoroids that enter the atmosphere
4. **Meteorite**—meteoroid that strikes Earth

C. **Asteroid**—rock similar to that which formed planets

1. Most asteroids lie in an asteroid belt located between Mars and Jupiter.
2. Jupiter's gravity may have kept these asteroids from forming a planet.
3. Some planets' moons may be asteroids pulled from the asteroid belt.
4. Asteroid sizes range from very tiny to 940 km in diameter.
5. The *Near Earth Asteroid Rendezvous* probe indicates asteroid 433 Eros has been in many collisions over time.

DISCUSSION QUESTION:

What likely caused craters on the surfaces of planets and moons? *Collisions with meteoroids or asteroids*